

**IN THE SPECIFICATION:**

Please amend the specification on page 1, lines 7 through 13, as follows:

The illumination with light radiated by ~~of~~ light-emitting diodes (LEDs) has a number of advantages compared to the illumination with light from conventional light sources, particularly light bulbs: The life of LEDs with up to 100,000 hours is plural times longer than the life of light bulbs, the color may be changed in almost any manner by selecting a suitable LED, the color temperature of a lamp composed of a plurality of differently colored LEDs may be set electronically and the electro-optical efficiency of LED radiators is higher nowadays compared to the efficiency of classical light bulbs.

Please amend the specification on page 2, lines 4 through 13, as follows:

From WO 02/054129 A1 which is the starting point of the invention ~~according to the preamble of claim 1~~, an illumination means is known consisting of a disc of a light-conductive material to whose edge a plurality of LEDs are coupled in juxtaposition via individual coupling elements, wherein the coupling elements each comprise a recess having a paraboloidal, metallized wall and wherein an LED-carrying sub-mount is arranged on the bottom of the recess. In this document, a coupling arrangement is also described, in which the LED-carrying sub-mount is formed as a micro-reflector and a coupling element for connecting an optical waveguide is aligned thereon, said ~~micro-reflector~~ micro-reflector comprising a paraboloidal deflection mirror to enable the a connection of the optical waveguide in a flat manner.

Please amend the specification on page 2, lines 14 through 24, as follows:

An opto-electronic component on which an optical waveguide is attached which has a cross section expanding or constricting from the component and which serves for bridging the distance between a circuit board carrying ~~he~~ the component and a housing front plate is known from the essay of F. Möllmer and G. Waitl: "Siemens SMT-TOPLED für die Oberflächenmontage, TEIL 2: Hinweise zur Anwendung", in Siemens Components 29 (1991), volume 5, pg. 193 – 196. The structure of the component is explained in more detail in DE 197 55 734 A1. According thereto it consists of a lead frame whose individual conductors that are electrically isolated from one another are connected to one another by a cast material, which at the same time forms a reflector surface, and of an opto-electronic semi-conductor element that is directly mounted on the lead frame and is bonded thereto.

Please amend the specification on page 2, line 25 through page 3, line 2, as follows:

According to DE 197 55 734 A1, a lens can be set onto the body formed by the cast material, said lens being centered at the body and opposing the semiconductor element at a distance, wherein the gap therebetween is filled by a transparent cast material. The document ~~reference~~ does not mention anything about the procedure how the semiconductor element is being positioned on the lead frame. For this purpose the die bond technology is known by the aid of which positioning accuracies which are better than  $\pm 70\mu\text{m}$ , however, cannot be achieved. As is shown, ~~the~~ The space available in the component ~~shown~~ for the accommodation ~~storage~~ of the semiconductor element, indeed allows such tolerances.

Please amend the specification on page 3, lines 3 through 11, as follows:

Illumination devices comprising ~~via~~ optical waveguides have become more popular during the last years. The light of the radiator must for this purpose be coupled into the optical waveguide, which, however, only conveys light up to a predetermined maximum angle against the optical waveguide axis. Light that is incident at greater angles is not guided by the optical waveguide but is radiated. As to the light source supplying the optical waveguide, this means that this source ideally is to couple light into the optical waveguide only in such a manner that said light is further conveyed by the optical waveguide. That means that the radiation angle of the light source shall not exceed a certain maximum radiation angle that depends on the type of the optical waveguide.

Please amend the specification on page 3, line 27 through page 4, line 8, as follows:

In order to still be able to utilize the light from LEDs in plastic housings of a diameter of 5 mm, which is radiated at steep angles to the vertical, reflectors are known from the prior art that can be set onto the plastic housing. Reference is made as an example to a catalog 2000/2001 of the company Osram München, page 97 and to a catalog of the distributor company Conrad, Hirschau, 2002, page 1097, according to which the reflector set on top increases the light intensity in the direction of the observer up to a factor 5. However, it can be recognized from the geometry of the reflector shown in the catalog that the light cannot be directed to an extent better ~~greater~~ than  $\pm 45^\circ$ . Since the reflector having a diameter of 12 mm is relatively large, its longitudinal extension and therefore the narrower bundling of the light would lead to component sizes that are difficult to handle. Moreover, the exposed,

sensitive inner surface of the mirror of the reflector set on top is to a restricted extent only suitable for hard ambient conditions.

Please amend the specification on page 4, lines 18 through 20, as follows:

It is the ~~The~~ object of the invention is to provide a light-emitting diode arrangement that can be used as a lamp, in which the light of the LED is bundled with a high efficiency to form a relatively narrow beam cone.

Please amend the specification on page 4, lines 21 through 22, as follows:

~~The object is solved by the features defined in claim 1. Further embodiments of the invention are subject matter of the dependent claims.~~

Please amend the specification on page 4, before line 23, as follows:

According to the invention, a light diode arrangement with a reflector is provided, comprising a sub-mount on which a light-emitting diode chip is mounted, and a reflector aligned at the sub-mount and which comprises a reflector surface located in the beam path of the light-emitting diode chip, wherein the sub-mount comprises a blind hole into which the light-emitting diode chip is inserted and comprises a paraboloidal reflector surface above the blind hole in whose focal point or focal line the center of the surface of the light-emitting diode chip is located, the reflector is formed by a solid body formed of a transparent material and comprising a small irradiation surface opposing the light-emitting diode chip and a large radiation surface opposing same at a distance, between which a lateral surface forming

the reflector surface extends, and that the sub-mount comprises an opening above the blind hole into which the reflector body is inserted with the radiation surface first so that its reflector surface forms a continuation of the reflector surface of the sub-mount.

To facilitate manufacture, in a preferred embodiment, the reflector body is a rotational-symmetric body in whose axis the LED chip is arranged.

To improve the intensity of reflected light, in another preferred embodiment, the reflector surfaces of the sub-mount and the reflector body are each formed paraboloidal.

Further, the reflector body preferably is held by a ferrule centered on the sub-mount.

In another preferred embodiment of the invention, the reflector surface of the reflector body is formed by four lateral surfaces adjoining one another, of which at least two opposing lateral surfaces generate a paraboloidal intersecting line on a plane vertically intersecting the lateral surfaces and the LED chip, wherein the four lateral surfaces and planes vertically intersecting said plane form lines of intersection which perpendicularly intersect one another.

Said two paraboloidally formed lateral surfaces of the reflector body may have an extension transversely to the paraboloidal extension that is much larger than the respective dimensions of the other lateral surfaces of the reflector body and that the incident surface of the reflector body is opposed by a plurality of adjoining LED chips that are held on the reflector body by means of their sub-mounts.

To enable the construction of specific illumination devices, in another preferred embodiment, the reflector body is a circular disc or a sector of a disc that has a circular opening in the center, said opening being delimited by an irradiation surface, and the disc or the disc sector has an outer periphery that is delimited by a radiation surface, wherein the irradiation surface and the radiation surface have cylinder surfaces being axially parallel,

and the lateral surfaces connecting same form paraboloidal lines of intersection with an axial intersecting plane, that approach one another in the direction towards the center of the disc or disc sector, and that the irradiation surface is opposed by a plurality of adjoining, star-like aligned LED chips that are held on the reflector body by means of their sub-mounts.

To improve the reflectivity of the device, the reflector surfaces of the reflector body are polished.

In order to improve the optical properties, the space between the LED chip and the irradiation surface of the reflector body is filled with a transparent, cured liquid plastic.

Please amend the specification on page 4, lines 23 through 26, as follows:

The invention allows the application e.g. as signal lamp of a rail vehicle, which ideally only radiates ~~illuminates~~ in the direction of the rails. However, a spot radiator as well that radiates in an aimed manner onto an object to be illuminated (exhibit in a museum, cigarette lighter in a motor vehicle, food illumination in a supermarket etc) requires directed light.

Please amend the specification on page 6, lines 21 through 31, as follows:

In order to extend the reflector, according to the invention a reflector body 8 consisting of transparent plastics (e.g. PMMA or PC) or clear glass is inserted into the reflector opening of the sub-mount 1, said reflector body when being inserted aligning precisely (i.e. by precise within some  $\mu\text{m}$ ) in the axial direction of the reflector 7 within the sub-mount 1. A transparent liquid plastic material 9 is filled between the LED chip 3 and the reflector body 8, said plastic material filling the entire free space of the sub-mount 1 in a

bubble-free manner. Light from the LED chip 3 which is incident not onto the sub-mount reflector 7 but onto the paraboloidal surface 10 of the reflector body 8 ~~not in the sub-mount reflector 7 but in the reflector body 8~~ has an angle to the surface of incidence that is so small that it is totally reflected. Even without a metallization of the reflector body 8 does a 100% light reflection take place.

Please amend the specification on page 7, lines 16 through 25, as follows:

The arrangement is preferably mechanically secured in the outer portion by a housing 12. This housing should preferably also center itself at the sub-mount 1 so that the entire component leads to an arrangement as in Fig. 3. A housing 12 can be recognized in Fig. 3, which contacts the reflector body 8 as little as possible so that light does not emerge from the reflector body 8 at the contact portion. A mechanical fixing must, of course, be given. Material 13 of low refractive index shall be located between the reflector body 8 and the housing 12, so that the reflector body 8 totally reflects the beams incident also at greater incident angles. The precise geometry and selection of the material depend on the concrete design. Air ( $n = 1$ ) but also ~~silicon~~ silicones ( $n \approx 1.4$ ) may be used as filling material of the gap.

Please amend the specification on page 8, lines 22 through 26, as follows:

The reflector body may also be designed with a geometry acting as a beam former only in a single space direction in that it is linearly extended while maintaining a paraboloidal cross section in a direction orthogonal to the cross section so that a respectively profiled disk or rail is provided, or by closing same into the shape of a ~~torus~~ toroid forming a

disc provided with a central opening.